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Abstract: Intervention forces are special, often state-run organizations that are in charge of surveillance and intervention tasks. Examples are police, medical emergency services, civil defense, and security firms. From a business processes view, intervention forces are a subset of organizations whose operational business is mobile. The contribution analyzes the potentials and limits of mobile business processes for intervention forces. It proposes first approaches in the direction of a fully-integrated process chain for these organizations with regard to the special rules of mobile business.

Keywords: intervention forces, mobile communication techniques, mobile added values, business process reengineering, mobile business processes

1. Introduction

In an intra- and inter-organizational scope, there are several possible uses of *mobile communication techniques* and devices. Particularly cellular phone networks have to be considered but often also Wireless LAN, Bluetooth or Infrared. *Mobile devices* are devices that were originally designed for mobile application. The spectrum thereby ranges from arbitrarily small devices, that could be even embedded into everyday equipment, to all kinds of mobile phones, handhelds and TabletPCs. Excluded are Laptops because its use does not comply with our understanding of mobile application (Turowski/Pousttchi 2003). Although it shares some characteristics with mobile devices in respect of autonomous power supply and possible mobile connectivity, it is rather designed for stationary use, as it is supposed to be switched off during transport from one place to another. In an organization, application of mobile communication techniques is often reduced to a technical issue. In reality it is not primarily a technical but an organizational problem. The real benefit of mobile solutions is the possibility to completely integrate mobile work places into intra- and inter-organizational processes. *Mobile work places* comprise many heterogeneous activities that can not be adequately supported by stationary use of IT. These activities can be divided into the four following categories:

- Employees in operational roles that are mobile on the premises,
- employees in operational roles that are mobile outside the premises,
- employees in operational and leading roles of organizations with mobile operations,
- and decision-makers.

Examples for the first category are a warehouseman that accepts, checks and issues goods at different places or an employee of a car rental agency that has to check returned cars. The second category includes activities in the field, like checking a delivery date or accessing customer profiles. In the third category one can mainly find *intervention forces* like police and emergency medical services but also construction companies that work on building sites. Examples for the fourth category are employees that have to make time-critical decisions and therefore need permanent access to aggregated company data.

In this contribution the suitability of mobile communication techniques for business processes of intervention forces will be analyzed. Chapter 2 describes common tasks of intervention forces and how they can be supported by information systems. In chapter 3 mobile added values are introduced as characteristic properties of mobile devices. There is also an overview of business process reengineering and its basic principles. Chapter 4 shows how the concepts of mobile added values and business process reengineering can be used to design new processes that fully integrate mobile technology. Some sample applications are described. In chapter 5 the results are summarized and an outlook is given.

Business Processes of intervention forces

2.1 Common tasks and information exchange

Intervention forces are special, in many cases state-run organizations that are in charge of tasks like surveillance, protection, and intervention. Examples are police, medical emergency services, fire departments, civil defense, and security firms. As already mentioned, business operations of these organizations are mobile, e.g. surveillance, first aid, fire extinguishing. The accomplishment of these activities requires at least basic information about type of assignment and location. But mostly, much more data is needed. For example, policemen have to check IDs or driver's licenses where data has to be verified against a central database. Ambulance men have to know which hospital has available capacity to take in the accident victims. Intervention forces are typically coordinated by an *operations control center (OCC)* where all information regarding a certain activity is stored and new information converges. Therefore an *information exchange* has to take place between operations control center and mobile forces. Purposes of this information exchange are:

- *Information retrieval*: Mobile forces need access to data in the central database to perform a certain task.
- *Assessment of situation*: Operations control center needs information about the actual situation on site, e.g. status of task completion, availability of forces in a particular area or environmental conditions.
- *Coordination and assignment of tasks*: Operations control center assigns tasks to mobile forces according to some coordination rules e.g. high-priority tasks are executed by a special group.

Depending on the type of a particular business operation the characteristics of information exchange vary. If up-to-date information is needed, the *frequency* of data transfers increases. If many persons are involved in performing a task then the *number* of information exchanges is higher. Sometimes, information has to be provided very quickly in order to guarantee correct decisions on site. Therefore the *urgency* of information exchange can differ, too. In the following, different types of business operations will be described on the basis of aforementioned purposes and properties of information exchange.

In the case of *crisis intervention* frequency, urgency, and number of information exchanges can be very high. Activities that have to be performed in an emergency situation depend on the type of the involved intervention forces, e.g. accidents require medical services, taking of hostages requires activities of a special task force of the police, and a fire has to be extinguished by fire fighters. In either case, information has to be provided very quickly in order to guarantee correct decisions and an immediate assignment of high-priority tasks. Depending on the extent of the crisis, several organizations and many persons may be involved, e.g. in case of a flood disaster. Then, assessment of the situation and coordination and assignment of tasks can require a high number and also a high frequency of information exchanges because situation and priorities may change quickly. However, in the case of a heart attack, only an emergency physician and two ambulance men will be involved. Information exchange will still be urgent and in some cases the frequency will also be high, e.g. if a search for a suitable hospital must be performed.

Within the scope of *protection* and *surveillance* tasks, information exchange is less urgent. Tasks are often assigned in advance, so that only changes have to be communicated once in a while. Status reports may be delayed for a couple of minutes and they are also not very frequent. The number of information exchanges is again dependent on the object that has to be observed respectively protected. Such an object could be a single person, a criminal gang but also a rock event with 40,000 spectators where hundreds of intervention forces are present. If an ID check for particular spectators is required, then the frequency caused by information retrieval could be high.

A third type of business operations are *investigation* and *instruction* tasks. Investigation includes primarily the conservation of evidence but also the questioning of witnesses. Examples for instruction tasks are inspections for fire prevention or education in the scope of accident

avoidance or healthcare. All these activities are coordinated in advance and necessary data will already be taken along. Therefore, an information exchange caused by information retrieval is very infrequent. An assessment of the current situation is also not necessary. Nevertheless, information is collected for afterward analysis. Thus, *acquisition of information* is a more suitable task for this type of business operation. It means that mobile forces collect data to be stored into the central database for further evaluation.

Besides these three types of business operations that form basic functions of intervention forces, there are also cross-sectional functions. *Operations planning and management* is the task that the OCC performs. Information has to be gathered and the current situation has to be assessed. Based on this assessment coordination of the mobile forces takes place. *Logistic functions* include transport services that are always necessary to send out mobile forces. Purchase and maintenance of equipment is also a logistic function. Finally, all activities have to be practiced in advance. Therefore, *training* is a cross-sectional function, too. Fig. 1 gives an overview of basic and cross-sectional function that where described above.

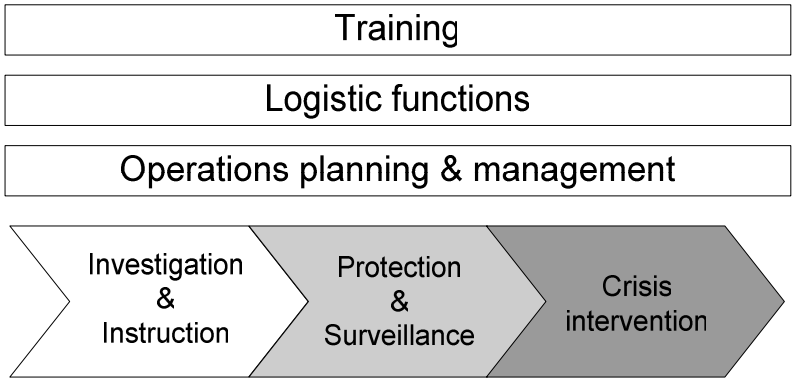

Fig. 1: Basic and cross-sectional functions of intervention forces

2.2 Information systems and integration

Execution of business processes is supported by business information systems. Fig. 2 shows different types of information systems arranged in an organizational pyramid. The pyramid describes the organization of activities and its corresponding positions. Operational activities are shown at the bottom and more strategic ones on top.

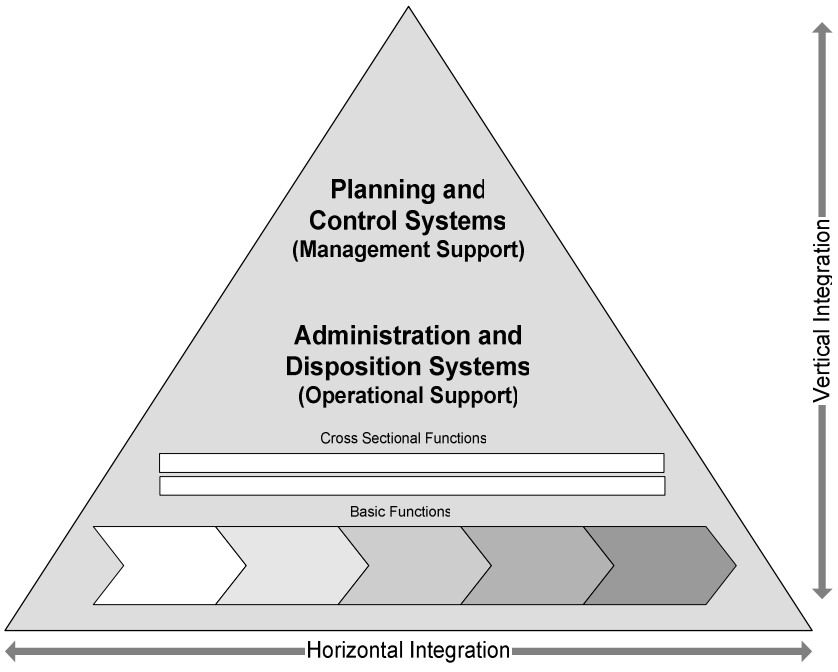

Fig. 2: Business application systems and direction of business integration

Administration systems are used for rationalization purposes. Single process steps are supported in order to save resources and time. Typically, they provide access to a large, logical database where all business transactions are stored and information about them can be retrieved. In our case, typical transactions would be storing of site plans or retrieving files of assignments. In an ongoing activity all important information can be entered into the system and accessed by other authorized persons. If a criminal has to be arrested his fingerprint and evidences of his crime can be retrieved. This evidence for example could have been collected in a previous surveillance task. Another example is the retrieval of patient data that was filed by a doctor some time before, in order to allow an adequate treatment in an emergency situation. *Disposition systems* add functionality to administration systems that support employees in decision making or even allow to automate parts of this process. For example, a fleet planning software gets data of all available cars from the administration system and automatically allocates them to different groups e.g. based on the number of persons that have to be transported. Administration and disposition systems are also called *operational systems* because they support day-to-day activities (Mertens, et al. 2004). On the contrary, p*lanning and control systems* support executives in decision making and strategy formulation. Planning systems ensure reliability of data for strategic planning so that computation of several alternatives is possible (Mertens, et al. 2004). For example, the management of the OCC could monthly check if the coordination rules for ambulance vehicles was suitable. If not areas of responsibility could be resized.

The examples have shown that administration systems can also be integrated i.e. data that was stored in an other context can be retrieved easily in a later step of the business process respectively at a later point of time when this data is needed again, e.g. for analysis or further processing. This can be true for different administration and disposition systems, then it is called horizontal integration. If operational and management support systems are integrated, this is called vertical integration. In either case the result is higher efficiency and better data quality.

2. Usage of mobile technology for reengineering of business processes

3.1 Effects of mobile communication techniques

In the field of electronic commerce an electronic offer is only considered to be successful (measured by frequency of use) if it is able to provide some added value. The *theory of informational added values* (Kuhlen 1996) terms these added values, resulting from the use of information and communication techniques as *informational added values (IAV)*. For example, added values with effectiveness impacts and added values with efficiency impacts in terms of time or cost can occur. These informational added values are caused by characteristic benefits of the technology that was used to create a particular electronically enhanced offer. Benefits that arise from the use of internet technology are called *electronic added values (EAV)* e.g. a purchase at an online-store can be initiated from everywhere in the world at any time. Typical advantages of the use of mobile communication technology and mobile devices in opposite to the exclusive use of not-mobile Internet technology are called *mobile added values (MAV)*. Some or all of these MAV will be the cause for any supplementary IAV of a defined mobile solution in opposite to its non-mobile counterpart (Pousttchi/Selk/Turowski 2002). Altogether four MAV can be identified:

The first characteristic of mobile communication technology is *ubiquity*, which describes the possibility to send and receive data anytime and anywhere. It is originated in the typical usage of mobile devices which accompany their user nearly anytime and anywhere. It permits the reception of time-critical and private information. Thereby and by persistent attendance for transactions it is possible to get e.g. warnings for exchange loss even if the recipient is not reachable by other forms of communication.

Another typical attribute is *context-sensitivity*, which describes the delivery of customized products or services fitting the particular needs of the user in his current situation. This can e.g. be achieved by determining the location of the user, by analyzing correlations with the location

of other users, by direct interaction or by personalized preference profiles. Typical applications based on the MAV of context-sensitivity are location based services.

Furthermore, the possibility to authenticate the owner of any mobile device through his subscriber identification is immanent to a cellular phone network. Along with the typical 1:1-attribution of a mobile device to its user (which is perhaps not true for any other technical device except a wristwatch) and the possibility to use further means of authentication on the device, this results in *identifying functions* of mobile devices. Possible effects are a high usability for transactions with monetary value or the opportunity to get very exact user profiles based on the behavior of the customer, enabling 1:1 marketing concepts.

The last characteristic are *command and control functions* of mobile devices. Mobile devices can be used as remote control for individual combinations of other devices using personal, local, or wide area networking capabilities. In the target device, control may be realized using ubiquitous computing concepts and technologies.

3.2 Principles of Business Process Reengineering

The goal of applying mobile communication techniques is to benefit from mobile added values. Important improvements can only be made by integrating mobile technology into business processes. As existing business process are not designed to accomplish that, there has to be a *business process reengineering* i.e. a fundamental rethinking and radical redesign of business processes (Hammer/Champy 1993). After an extensive problem definition a completely new process is defined by utilizing new potentialities, in this case mobile technology. Then this new process is compared to the old one so that improvements but also constraints can be identified. Typically, simpler processes can be found as the result of elimination, integration or automation of sub-processes. The goal of business process reengineering is a high quality process that takes advantage of modern technology and therefore achieves improvements in critical measures of performance, such as cost, quality and time. Methods to design high quality processes are (Hammer/Champy 1993):

- Combination of several jobs into one: Processes are horizontally integrated and consequently avoid handoffs that cause errors and misunderstandigs.
- Employees are empowered: Not only are decisions made by managers but also by employees that perform operational tasks. That leads to a vertical integration of activities because decision and execution are not longer decoupled.
- Process steps are “delinearized”: Tasks are performed in a natural order, and if possible, work is done simultaneously to speed up the process and to avoid inconsistency caused by delayed work.
- Multiple versions of a process are provided: A single process has to incorporate special procedures and exceptions to handle a wide range of situations. If there are already multiple versions of common processes, exeption handling can be reduced.
- Work is performed where it makes the most sense: Not every problem requires a specialist to be solved. Some common problems can probably be mastered locally without calling a specialist. Thus, unnecessary handoffs will be avoided.
- Usage of information technology to benefit from hybrid centralized/dezentralized operations: A central information source provides aggregated data as a basis for decisions. But there is no central control over decision-making.

By applying these methods in a reengineering process, a number of disadvantages in processes can be eliminated. Unnecessary handoffs and inquiries are avoided. They would cause waiting time, inconsistencies and resultant trouble-shooting, and that would reduce the overall process duration and quality. Resources can be saved and costs are decreased. The use of information technology allows to further speed up the process while not cutting back process quality.

In the following it should be analyzed with the aid of MAV how mobile communication techniques are suitable to achieve that. The most important MAV for optimization of processes is ubiquity. On the one hand it allows availability of needed information to make decisions any

time at any place. On the other hand processes don't have to be interrupted because decision makers are not present. Context-sensitivity and identifying functions help to customize information to the current situation of an employee, so that he can make better decisions or solve problems without further help. Command and control functions may reduce delays caused by transport and save working time if it is possible to solve problems remotely. Central questions for optimization of processes with the help of mobile technology are:

- How will the process change when interaction is possible at any place and time? Will freedom of movement of the organization's members increase?
- In which cases efficiency advantages are generated due to speed improvements?
- Can information sources be linked together more effectively or efficiently?
- Which presentation of information on a mobile device is adequate to provide better and faster decisions?

But it is also important to keep in mind that the interrelation between the use of mobile technology and the fundamental redesign of processes – on the basis of business process reengineering (BPR) – is bidirectional:

- Effective and efficient use of mobile technology is reached only after a redesign of business processes.
- The fundamental redesign of business processes is facilitated by the potentials of mobile technology i.e. the use of mobile added values.

Therefore, implementing mobile technology must go along with the redesign of business processes.

3. Mobile business processes for intervention forces

In chapter 3 it was explained how MAV are suitable to be used in business process reengineering. Now the potential of mobile business processes in the domain of intervention forces will be described. For this, general properties of data handling have to be identified. Data is mainly stored in the central database of the headquarters and is accessible through administration systems. There are several options for handling integrated data on mobile devices in order to benefit from its ubiquity:

- Data that should be available on a mobile device can either come from the headquarters i.e. stored in the central database (administration systems) or provided by the operations contol center (supported by disposition systems), or from manual data input (data gathering).
- Data can either be copied prior to the start of the mobile activity or it is transferred during the activity (data access). In this case online access or download of data is possible. Since online access requires a reliable connection, download is the option that will be more likely. In this case, the reasonable amount of transfer data is limited due to bandwidth. It may also be limited due to memory restrictions of the device.
- Data can either be transferred by pushing data to the device by OCC or by pulling data from the database.

In the following, sample applications for several business operations will be described that use ubiquity and the other three mobile added values to create a continuous process chain with integrated mobile technology.

The possibility of on-site data input leads to improvements regarding the process of inspections for fire preventions in buildings (Lerner/Frank 2004). All deficiencies that are detected have to be filed so that in a second inspection (four weeks later) these can be checked again. For each deficiency a special code exists that must be recorded. There is a total of over thousand codes that are listed in a handbook. Mobile devices allow input of data into a digital form instead of filling out a form paper. The codes are also available digitally, so that there is no need to look them up in the handbook. Later, the collected data can be synchronized with the central database.

The process of checking driver's licenses by policemen can be improved by using mobile technology for data access (Ney/Wagner 2004). Today, the OCC is the bottleneck in the process. Policemen have to wait two minutes on the average until their inquiry using the radio

handset can be accepted. Then they have to spell the name as well as the date of birth to avoid mistakes due to the bad transmission quality. After that the actual information retrieval takes place. With mobile devices information can be pulled directly from the central database instead of requesting it from the OCC. This would avoid waiting time for mobile forces. Additionally, employees of the OCC can focus on tasks with higher priority.

Assessment of situation as well as coordination of tasks by the OCC can also be improved by using context-sensitivity and identifying functions of mobile devices. Positions of every intervention force member could be determined and displayed on an electronic map in the headquarters. Decisions based on this assessment could result in instructions that are pushed to the mobile devices. In a crisis situation the resultant increase of speed could be deciding. This is also true for emergency medical services. Mobile devices can be used to notify the OCC about an accident that was observed. A context-sensitive application could automatically locate the place of accident and automatically provide driving directions for the ambulance vehicle and the emergency physician. Typically there is a delay of several minutes between the arrival of the ambulance vehicle and the arrival of the emergency physician. This time could be used to transfer information about the accident victim's vital functions to the emergency physician so that he prepare for his assignment (Kirn/Heine/Anhalt 2001).

From a business process reengineering point of view these solutions would include several principles like *empowering of employees*, *delinearizing of process*, and *work is performed where it makes the most sense*. It is also possible to answer some of the central questions given in section 3.2: Speed improvements that are especially beneficial in crisis situations are definitely possible with the use of mobile technology. Freedom of movement will not really increase, because processes are mobile anyway. But now existing processes can be better supported. Information sources can be linked together more effectively what primarily improves the assessment of situation. The question about the adequate presentation of information cannot be completely answered. It is clear that this presentation has to take account of the particular device type and business operation. In case of an emergency situation nobody wants to read pages full of text to get desired information. A context-sensitive solution has to be implemented that customizes the presentation of information. Nevertheless, it also depends on the people that have to use the technology. If devices are for example not robust enough or presentation is not adequate (even if it's context-sensitive), people would probably not benefit from integration of mobile technology.

4. Summary and outlook

The use of mobile technology is suitable for business processes of intervention forces, because they belong to the category of organizations with mobile operations. The type of business operation determines the characteristics of the information exchange between the operations control center and the mobile forces. This fact is leading to different possible applications of mobile communication techniques respectively its mobile added values ubiquity, context-sensitivity, identifying functions, and command & control functions. Suitable new business processes and corresponding applications can be found by performing a business process reengineering in consideration of mobile technology. At the same time improvements in cost, quality, and process duration can be achieved. Therefore business processes of all kinds of intervention forces should be analyzed in order to determine suitable new applications and tap the full potential of mobile communication techniques.

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